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Calorimetric Glass Transition in Vitreous Silica

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The glass transition is one of the important topics for condensed matter research. Though considerable progress has been made in understanding the glass transition in general, some crucial questions still remain unanswered. One of these questions is related to the anomalous features of glass transition in vitreous silica. By performing differential scanning calorimetric (DSC) experiments, I have observed new anomalous features of the calorimetric glass transition of vitreous silica besides those known in literature. First, the shape of the heat capacity jump from glassy to liquid state becomes distorted after a certain number of the DSC scans (up to 1350 ºC). Second, the onset glass transition temperature (T_g) decreases with increasing number of DSC scans, and reaches a constant value after a certain number of DSC scans. Third, there is a striking difference in the shape of the glass transition peak between bulk and fiber vitreous silica, even if they both undergo the same thermal history prior to calorimetric scans. These features, along with high sensitivity of the T_g to hydroxyl content, are probably the main reasons why there is still lack of a generally accepted T_g value for the vitreous silica in the glass community. By considering the above-mentioned anomalous features I suggest an approach for determining the standard T_g of vitreous silica. The origin of those features of vitreous silica is discussed from the energetic and the structural aspects.